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10/034,780	12/27/2001	Ioannis Pavlidis	H0002442-2	1212

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HONEYWELL INTERNATIONAL INC.
101 COLUMBIA ROAD
P O BOX 2245
MORRISTOWN, NJ 07962-2245

EXAMINER	
LAVIN, CHRISTOPHER L	
ART UNIT	**PAPER NUMBER**
2624	

DATE MAILED: 08/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/034,780	PAVLIDIS ET AL.	
	Examiner	Art Unit	
	Christopher L. Lavin	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 June 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-14 and 17-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-14 and 17-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 May 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *03/23/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 4 – 7, 14 and 17 – 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stauffer et al. ("Adaptive background mixture models for real-time tracking", Proceedings 1999 IEEE Conference on Computer Vision and Pattern Recognition, Fort Collins, Col., 1999 June 23 – 25; 2:246 – 252) in view of Menon (5,537,488).

In regards to claim 1, Stauffer discloses a method for use in monitoring a search area, the method comprising (in the second paragraph of the abstract on page 246 a "stable, real-time outdoor tracker which reliably deals with lighting changes, repetitive motions from clutter, and long-term scene changes." Stauffer is disclosing a method for monitoring a search area, which must be preformed for tracking.):

providing frames of image data representative of a search area, the image data comprising pixel value data for a plurality of pixels (In the second paragraph of the introduction on page 246 Stauffer discloses using the tracking method for video surveillance. Inherent in video surveillance is the step of providing frames of image data representative of the search area. As a computer must perform this method the image data must comprise of pixel value data.);

providing a plurality of time varying Gaussian normal distributions for each pixel generated based on the pixel value data over a plurality of frames of the image data

(Stauffer discloses providing a plurality of time varying distributions on page 248 in the second column, second full paragraph. "The recent history of each pixel [...] is modeled by a mixture of K Gaussian distributions.");

providing at least one frame of update image data representative of the search area in an update cycle, the at least one frame of update image data comprising update pixel value data for each of the plurality of pixels (As previously noted Stauffer's tracking method is designed to deal with "long-term scene changes" and thus every image frame can be considered an update image, the frame would comprise of update pixel value data for each of the plurality of pixels. Stauffer notes in the first partial paragraph on page 249, "so we use an approximate method which essentially treats each new observation as a sample set of size 1 and uses standard learning rules to integrate the new data."); and

attempting to match the update pixel value data for each pixel [to each of all] of the plurality of time varying distributions provided for the pixel, wherein attempting to match the update pixel value data for each pixel to each of all of the plurality of time varying distributions provided for the pixel comprises: (In the first full paragraph on page 249 Stauffer discloses the step of attempting to match the update pixel data to the time varying distributions. "Every new pixel value, X_t, is checked against the existing K Gaussian distributions, until a match is found.")

creating a narrow distribution for the pixel based on the update pixel value data and a predetermined variance, the narrow distribution being narrow relative to the plurality of time varying distributions (In the first full paragraph on page 249 that the

matching step defines a narrow distribution), computing a divergence measure between the narrow distribution created for the pixel and each of the plurality of time varying distributions provided for the pixel resulting in a plurality of divergence measures corresponding to the plurality of time varying distributions for the pixel (in the first full paragraph on page 249 that "a match is defined as a pixel value within 2.5 standard deviations of a distribution". Computing a divergence would be necessary to find a match in the method disclosed by Stauffer. Stauffer as acknowledge only performs this operation until a first match is found, thus Menon has been provided to teach that each distribution is checked and then the best result is chosen.), [determining a minimum divergence measure of the plurality of divergence measures], and comparing the minimum divergence measure to a predetermined cutoff to determine if a match exists of does not exist (in the first full paragraph on page 249 that "a match is defined as a pixel value within 2.5 standard deviations of a distribution".);

updating the plurality of time varying distributions for each pixel based on whether the update pixel value data matches one of the plurality of time varying distributions provided for the pixel (Stauffer notes in the second full paragraph on page 249 that "if none of the K distributions match the current pixel value, the least probable distribution is replaced". This is the step of updating the plurality of time varying distributions based on whether there is a match or not.); and

ordering the updated plurality of time varying distributions for each pixel based on a probability of the time varying distributions thereof being representative of background or foreground information in the search area for use in determining whether the pixel is

to be considered background or foreground information (The second full paragraph on page 249 shows that the time varying distributions are ordered. Finally in the second paragraph of Background Model Estimation on the same page Stauffer discloses that the time varying distributions represent either background or foreground (new object). Stauffer further shows that background and foreground are differentiated in the first paragraph under Connected Components on page 250, "the method described above allows us to identify foreground pixels in each new frame".).

As the applicant has pointed out in remarks filed on 06/03/05 Stauffer does not attempt to match the update pixel value data to every time varying distributions, but instead stops at the first distribution that meets the requirements for a match.

Menon teaches (col. 5, line 50 – col. 6, line 8) in the area of pattern recognition that a pattern should be compared to every category. And then the best match should be selected. This is the same concept as what is being described in the claimed invention.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to compare the update pixel value data to every distribution before declaring a match (as taught by Menon) in the method disclosed by Stauffer. Depending on the variance allowed in a match by Stauffer the first "match" found could be far from ideal. By checking through all of the distributions the best match can be found which will lead to more accurate results.

In regards to claim 4, Stauffer discloses the method of claim 4, wherein updating the plurality of time varying distributions for each pixel comprises generating a pooled

distribution based on the narrow distribution and a matched distribution if the narrow distribution matches one of the plurality of time varying distributions, and further wherein ordering the updated plurality of time varying distributions comprises determining if the pixel is representative of background or foreground information in the search area based on a position of the pooled distribution within the order of the updated plurality of time varying distributions (the majority of this claim has already been addressed above; the pooled distribution was shown in claim 1. It has already been shown that Stauffer differentiates foreground and background. Stauffer in the first full paragraph in the second column of page 249 that while a pixel is in the foreground it will be at the front of the distribution list, once it reverts back to background the foreground distribution will quickly fall off the list. Thus the list is ordered by the distinction between foreground and background.).

In regards to claim 5, Stauffer discloses the method of claim 2, wherein updating the plurality of time varying distributions for each pixel comprises replacing one of the plurality of time varying distributions with a new distribution if the narrow distribution does not match one of the plurality of time varying distributions, and further wherein ordering the updated plurality of time varying distributions comprises assuring that the new distribution is representative of foreground information in the search area (the majority of this claim has already been addressed above, in particular the steps of replacing one of the distributions. As shown prior, Stauffer discloses in the first paragraph of the Connected Components section on page 250 that foreground pixels are identified.).

In regards to claim 6, Stauffer discloses the method of claim 1, wherein ordering the updated plurality of time varying distributions for each pixel is based on weights associated with the plurality of time varying distributions (Stauffer discloses in the third full paragraph on page 249 that the ordering of the plurality of time varying distributions for each pixel is based on weights associated with the plurality of time varying distributions.).

In regards to claim 7, Stauffer discloses the method of claim 1, wherein at least a portion of the foreground information corresponds to one or more moving objects, and further wherein the method comprises tracking the one or more moving objects in the search area to determine object paths for the one or more moving objects (Stauffer discloses in the two paragraphs under the Connected Components category on page 250 that parts of the foreground are grouped into moving objects. Finally in the second paragraph under Multiple Hypothesis Tracking Stauffer discloses that multiple hypotheses tracking is used to track moving objects.).

In regards to claim 14, the new material in the claim is rejected for the same reasons as provided above for claim 1. The remainder of the claim is rejected for the same reasons as presented in the office action dated 08/25/05.

In regards to claim 17, Stauffer discloses the system of claim 15, wherein the computer apparatus is further operable, with respect to each pixel, to:

update the plurality of time varying distributions by generating a pooled distribution based on the narrow distribution and a matched distribution if the narrow distribution matches one of the plurality of time varying distributions (the majority of this

claim has already been addressed above; the pooled distribution was shown in claim 16.); and

determine if the pixel is representative of background or foreground information in the search area based on position of the pooled distribution within the order of the updated plurality of time varying distributions (It has already been shown that Stauffer differentiates foreground and background. Stauffer in the first full paragraph in the second column of page 249 that while a pixel is in the foreground it will be at the front of the distribution list, once it reverts back to background the foreground distribution will quickly fall off the list. Thus the list is ordered by the distinction between foreground and background.).

In regards to claim 18, Stauffer discloses the system of claim 15, wherein the computer apparatus is further operable, with respect to each pixel, to:

update the plurality of time varying distributions by replacing one of the plurality of time varying distributions with a new distribution if the narrow distribution does not match one of the plurality of time varying distributions (the majority of this claim has already been addressed above, in particular the steps of replacing one of the distributions); and

assure that the new distribution is representative of foreground information in the search area (As shown prior, Stauffer discloses in the first paragraph of the Connected Components section on page 250 that foreground pixels are identified.).

In regards to claim 19, Stauffer discloses the system of claim 14, wherein the computer apparatus is further operable to order the updated plurality of time varying

distributions for each pixel based on weights associated with the plurality of time varying distributions (Stauffer discloses in the third full paragraph on page 249 that the ordering of the plurality of time varying distributions for each pixel is based on weights associated with the plurality of time varying distributions.).

In regards to claim 20, Stauffer discloses the system of claim 14, wherein at least a portion of the foreground information corresponds to one or more moving objects, and further wherein the computer apparatus is operable to track the one ore more moving objects in the search area to determine object paths for the one or more moving objects (Stauffer discloses in the two paragraphs under the Connected Components category on page 250 that parts of the foreground are grouped into moving objects. Finally in the second paragraph under Multiple Hypothesis Tracking Stauffer discloses that multiple hypotheses tracking is used to track moving objects.).

3. Claims 8 – 10 and 21 – 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Stauffer and Menon in view of Sacks (4,739,401).

In regards to claims 8 and 21, Stauffer discloses in the first paragraph in the Connected Components section segmenting (calculating blobs) the foreground with the "connected components algorithm". Stauffer, however, does not disclose filtering out blobs have less than a predetermined pixel area size.

Sacks teaches in the paragraph starting on column 4, line 29 that size can be used to filter out "objects from the image being processed which are not potential targets". "The size identification subsystem provides second output signals indicative of objects located within the image scene whose sizes are within a predetermined size

range." Thus Sacks teaches that blobs having less than a predetermined pixel area size are filtered out.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to use size to filter out objects that are two small, as taught by Sacks, before performing the tracking operations as disclosed by the combination of Stauffer and Menon. If an outdoor tracking system is intended to track cars or people having a size cut off for objects of interest makes sense as small animals, leaves, and other small objects would be tracked without the cut off, leading to wasted processing time.

In regards to claims 9, 10, 22, and 23, Stauffer discloses in the second paragraph in the Multiple Hypotheses Tracking section on page 250 that connected components are grouped into object paths (this is the correspondence between frames Stauffer writes about in the paragraph) using a multiple hypotheses tracking algorithm.

Claims 11,12, 24, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Stauffer and Menon in view of Baxter (5,966,074).

In regards to claim 11, Stauffer teaches of using the tracking method disclosed for tracking objects in an outdoor environment as well as classifying those objects (people and cars), however Stauffer does not disclose classifying object paths as normal or abnormal.

Baxter teaches in the paragraph starting at column 7, line 65 that object path models can be created based on position, trajectory, angle, and speed and used to

identify an object path as either normal or abnormal (sets off an alarm). An object path is then compared to these models to classify that object path.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to add a path classifying module as taught by Baxter to the tracking method disclosed by the combination of Stauffer and Menon. Being able to classify a path as normal or abnormal would be useful to the tracking method, as it would allow for a complete surveillance system. For example if the method is used to track cars with the path classification added in the method will be able to identify speeding cars for ticketing.

In regards to claim 12, Stauffer in view of Baxter discloses the method of claim 11, wherein providing one or more defined normal and/or abnormal object path feature models comprises providing one or more defined threatening and/or non-threatening object path feature models based on one or more characteristics associated with threatening events (threatening paths and non-threatening paths can be correlated to abnormal/normal paths respectively.); and

wherein comparing the one or more object paths to the one or more defined normal and/or abnormal object path feature models comprises comparing at least the one or more object path, or data associated therewith, to the one or more defined threatening and/or non-threatening object path feature models to determine whether the one or more object paths appear to indicate that a threatening event is occurring (One threatening characteristic disclosed by Baxter as shown above in the rejection of claim

11 is speeding. Again as shown by Baxter if a threatening object path is detected an alarm is activated. The rest of this claim is addressed in the rejection of claim 11.).

In regards to claims 24 and 25, Stauffer teaches of using the tracking method disclosed for tracking objects in an outdoor environment as well as classifying those objects (people and cars), however Stauffer does not disclose classifying object paths as normal or abnormal.

Baxter teaches in the paragraph starting at column 7, line 65 that object path models can be created based on position, trajectory, angle, and speed and used to identify an object path as either normal or abnormal (sets off an alarm). An object path is then compared to these models to classify that object path.

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to add a path classifying module as taught by Baxter to the tracking system disclosed by the combination of Stauffer and Menon. Being able to classify a path as normal or abnormal (non-threatening or threatening) would be useful to the tracking method, as it would allow for a complete surveillance system. For example if the system is used to track cars with the path classification added in the method will be able to identify speeding cars for ticketing.

Claims 13 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Stauffer and Menon in view of Uyttendaele.

In regards to claims 13 and 26, Stauffer discloses a method and system for tracking objects. Stauffer however, does not discuss combining multiple imaging devices into one overlapping image for use in tracking.

Uyttendaele discloses in figure 3A a method for combining a plurality of frames of image pixel data. In step 300 Uyttendaele acquires multiple frames of image pixel data. In the paragraph starting at column 4, line 45 Uyttendaele discloses, "a camera 163 capable of capturing a sequence of images 164 can also be included as an input device to a personal computer." Any image inputted into a computer must be comprised of pixels. Uyttendaele then discloses in the paragraph starting at column 5, line 50 that each frame is "captured by a different cameras from a different viewpoint." Uyttendaele discloses in the paragraph starting at column 7, line 41 that "the lateral field of view of each camera overlaps by at least 20 percent." This is about 25 percent. As each image would overlap with two other images the total overlap for any one image would be about 40 percent. This is less than 85 percent of the field of view. Returning to figure 3A Uyttendaele discloses in step 306 that the image frames are combined (mosaic).

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to use multiple overlapping cameras as taught by Uyttendaele to obtain a complete search area at high resolution for tracking as disclosed by the combination of Stauffer and Menon. By using multiple cameras a higher resolution image can be obtained which allows for more detail and thus more accurate tracking.

Response to Arguments

4. Applicant's arguments filed 06/19/06 have been fully considered but they are not persuasive.

5. The examiner would like to again state that Menon was brought in to teach a simple and well known concept in the art. That concept was to check was to check all

possible items for a match and then select the best match. Menon clearly teaches this. Menon compares a pattern to every possible category, then the best match is chosen. There is clear motivation to make this change to Stauffer, both in what the examiner has provided and even in Menon, for example (col. 5, line 65 – col. 6, line 8) Menon teaches that a pattern can be matched to multiple categories, as long as it meets a threshold. Stauffer also uses a threshold to determine a match. So Menon is teaching that a match threshold is not good enough to guarantee the best match, and therefore all of the categories should be checked before determining a best match. Obviously using the best match instead of the first match will lead to more accurate results.

6. In regards to applicant's first argument "there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify Stauffer et al. with the teachings of Menon et al."

The examiner did provide motivation and as previously discuss Menon also provides motivation for this combination. As cited in MPEP 2143.01

> "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art."

The examiner is one of ordinary skill in the art, and therefore has provided the motivation required to prove obviousness. It should also be pointed out that in the art of image processing the definition of one of ordinary skill in the art is quite high.

Conclusion

The examiner would like to suggest that instead of focusing on the "each of all" language that the applicant should try to find material in the specification that different from Stauffer to make the claims allowable. The newly added material in the claims seem to focus entirely on the concept of checking all of the distributions instead of stopping at the first match (as taught by Stauffer), but as shown previously the Menon teaches this concept. Thus the combination of Stauffer and Menon teach checking all of the distributions before determining a match.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher L. Lavin whose telephone number is 571-272-7392. The examiner can normally be reached on M - F (8:30 - 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh M. Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Christopher Lavin

BHAVESH M. MEHTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600